INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
We Protect Hoosiers and Our Environment.

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April 16, 2012

Ms. Susan Hedman
Regional Administrator
U.S. Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3950

Dear Ms. Hedman:

Re: MOBILE6.2 to MOVES MVEB Replacement Update to the Indianapolis, Indiana Maintenance Area under the 1997 8-Hour Ozone Standard

The Indiana Department of Environmental Management (IDEM) submits the enclosed MOBILE6.2 to Motor Vehicle Emissions Simulator (MOVES) Motor Vehicle Emissions Budget (MVEB) replacement update for the Indianapolis, Indiana maintenance area under the 1997 8-hour ozone standard. The Indianapolis, Indiana maintenance area includes Boone, Hamilton, Hancock, Hendricks, Johnson, Madison, Marion, Morgan, and Shelby counties. IDEM requests that the United States Environmental Protection Agency (U.S. EPA) process this final submittal for approval into Indiana's State Implementation Plan.

IDEM provided an opportunity for a public hearing on the MVEB replacement update to the Indianapolis, Indiana maintenance area if a public hearing request was received by March 22, 2012. A hearing was scheduled for March 29, 2012. No request for a public hearing was received and the hearing was cancelled. In addition, IDEM received no comments during the public notice process.

This MOBILE6.2 to MOVES MVEB replacement update incorporates onroad emission estimates and revised MVEBs using U.S. EPA's recently adopted MOVES model. The onroad emission estimates were calculated using the MOVES-based emission factors and data extracted from the Indianapolis, Indiana area's travel-demand model.

MVEBs are being revised in anticipation of the mandatory use of the MOVES model in future transportation conformity determinations. Preliminary use of the new model indicates that emission estimates can be considerably different than similar calculations using MOBILE6.2, which was used to create the MVEBs in the original ozone maintenance plan.

Onroad safety margins, established through the interagency consultation process, are included for nitrogen oxides (NO_x) and volatile organic compounds (VOCs). These onroad safety margins are allocated to onroad emission estimates in order to account for the wide array of assumptions that are factored into the calculation process. With the addition of onroad safety margins applied to mobile sources, the maintenance area of Indianapolis, Indiana will continue to remain well below the overall safety margins for all sources. MVEBs are also constrained to ensure that total NO_x and VOC emissions (i.e., all source categories) do not exceed attainment year emissions, to ensure continued maintenance of the 1997 8-hour ozone standard.

This submittal consists of one (1) hard copy of the required documentation. An electronic version of the submittal in PDF format that is identical to the hard copy has been sent to Pamela Blakley.

IDEM respectfully requests that U.S. EPA proceed with final review of the MOBILE6.2 to MOVES MVEB replacement update and revised transportation conformity budgets and approval into Indiana's State Implementation Plan for the Indianapolis, Indiana Maintenance Area Under the 1997 8-Hour Ozone Standard. If you have any questions or need additional information, please contact Scott Deloney, Chief, Air Programs Branch, at (317) 233-5694.

Sincerely,

Keith Baugues

Keith Baugues
Assistant Commissioner
Office of Air Quality

KB/sad/sms
Enclosure:
MOBILE6.2 to MOVES MVEB Replacement Update to the Maintenance Area of Indianapolis, Indiana for the 1997 8-Hour Ozone Standard

Cc: Doug Aburano, U.S. EPA Region 5 (w/ enclosures)
Ed Doty, U.S. EPA Region 5 (w/ enclosures)
Pamela Blakley, U.S. EPA Region 5 (w/ enclosures)
Pat Morris, U.S. EPA Region 5 (w/ enclosures)
Steve Rosenthal, U.S. EPA Region 5 (no enclosures)
Philip Roth, IMPO (w/ enclosures)
Jerry Bridges, MCCOG (w/ enclosures)
Scott Deloney, IDEM (no enclosures)
Christine Pedersen, IDEM (no enclosures)
Shawn Seals, IDEM (w/ enclosures)

Onroad Emissions MOBILE6.2 to MOVES Replacement Submittal

For the Indianapolis, Indiana Maintenance Area Under the 1997 8-Hour Ozone Standard

April 2012

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Introduction

On March 26, 2007, the Indiana Department of Environmental Management (IDEM) submitted a *Request for Redesignation and Maintenance Plan for Ozone Attainment in the 8-Hour Ozone Nonattainment Area, Central Indiana Area*. The United States Environmental Protection Agency (U.S. EPA) subsequently approved the Indiana redesignation of the Central Indiana Area to attainment for ozone on October 19, 2007 (72 FR 59210). Onroad emissions for the March 26, 2007, submittal were calculated using MOBILE6.2. U.S. EPA has encouraged mobile source stakeholders to transition to the new Motor Vehicle Emissions Simulator (MOVES) model as expeditiously as possible. Therefore, IDEM is providing this MOBILE6.2 to MOVES replacement update to the previously submitted 8-hour ozone maintenance plan for the Central Indiana Area that incorporates MOVES-based onroad emissions.

Emission Inventory

Table 4.1 was included without title in Appendix C of the original Redesignation Petition and Maintenance Plan. Table 4.1 – A (to be considered a replacement of the table included in Appendix C) has been revised to incorporate updated onroad emission estimates for the years 2005, 2010, 2015 and 2020; it results in a different overall safety margin for the area.

Table 4.1
Comparison of 2005 and 2010 Estimated and 2015 and 2020 Projected Emission Estimates in Tons Per Summer Day, Central Indiana Area (MOBILE6.2-based Onroad Emissions)

Sector	2005 NO_x	2010 NO_x	2015 NO_x	2020 NO_x
Area	24.26	22.39	23.12	22.74
Nonroad	22.55	33.05	24.06	18.36
Onroad	~~116.74~~	~~78.40~~	~~55.42~~	~~32.45~~
Point	56.63	33.31	32.41	32.77
Total	**~~220.18~~**	**~~167.15~~**	**~~135.01~~**	**~~106.31~~**
Sector	**2005 VOC**	**2010 VOC**	**2015 VOC**	**2020 VOC**
Area	94.85	99.29	106.31	100.81
Nonroad	30.36	28.77	24.06	25.29
Onroad	~~60.50~~	~~44.19~~	~~35.33~~	~~26.47~~
Point	13.54	14.34	16.00	14.85
Total	**~~199.25~~**	**~~186.58~~**	**~~181.69~~**	**~~167.42~~**

Table 4.1 – A
Comparison of 2005 and 2010 Estimated and 2015 and 2020 Projected Emission Estimates in Tons Per Summer Day, Central Indiana Area (MOVES-based Onroad Emissions)

Sector	2005 NO_x	2010 NO_x	2015 NO_x	2020 NO_x
Area	24.26	22.39	23.12	22.74
Nonroad	22.55	33.05	24.06	18.36
Onroad	226.34	134.68	89.02	62.72
Point	56.63	33.31	32.41	32.77
Total	**329.78**	**223.43**	**168.61**	**136.59**
Overall Safety Margin	–	106.35	161.17	193.19
Sector	**2005 VOC**	**2010 VOC**	**2015 VOC**	**2020 VOC**
Area	94.85	99.29	106.31	100.81
Nonroad	30.36	28.77	24.06	25.29
Onroad	69.19	47.35	31.06	22.74
Point	13.54	14.34	16.00	14.85
Total	**207.94**	**189.75**	**177.43**	**163.69**
Overall Safety Margin	–	18.19	30.51	44.25

Onroad emission estimates in Table 4.1 – A were calculated using U.S. EPA's MOVES model-produced emission factors and data extracted from the area's travel-demand model. The MOVES model implements a significantly different approach to emissions estimation than the previous model (MOBILE6.2). Preliminary use of the MOVES model indicates that emission estimates can be considerably different than similar calculations using MOBILE6.2, which was used to create the original Motor Vehicle Emission Budgets (MVEBs) for the Central Indiana Area. A general summary of the MOVES methodology used in this area can be found in Appendix A. In addition, MOVES input and output files are being provided electronically with this submittal. Growth and control strategy assumptions for non-mobile sources (i.e. area, nonroad, and point) from the original submittal for the years 2005, 2010, 2015 and 2020 were developed before the down turn in the economy over the last several years. Because of this, the factors included in the original submittal may project more growth than will actually occur in the future. As a result, the growth and control strategy assumptions for the non-mobile sources for the years 2005, 2010, 2015 and 2020 continue to be valid and do not affect the overall conclusions of the plan.

Onroad safety margins have been included for onroad emission estimates to accommodate the wide array of assumptions that are factored into the calculation process. Since assumptions change over time, it is necessary to have an onroad safety margin that will accommodate the impact of refined assumptions in the process. The plan continues to meet all applicable Clean Air Act (CAA) requirements as the revised emission inventories clearly illustrate that total NO_x and VOC emissions in the Central Indiana Area will continue to decline leading to local reductions between 2005 (base year) and 2020 (maintenance plan horizon).

Transportation Conformity Budgets

Table 5.2 was included on Page 20 of the original Redesignation Petition and Maintenance Plan. Table 5.2 – A (to be considered a replacement of Table 5.2) has been revised to incorporate MVEBs calculated using U.S. EPA's MOVES model-produced emission factors and data extracted from the region's travel-demand model.

Table 5.2
Motor Vehicle Emission Budgets for the Central Indiana Area
(MOBILE6.2-based Onroad Emissions)

	2006	2020
NO_x	106.19	35.69
VOC	54.32	29.52

Table 5.2 – A
Motor Vehicle Emission Budgets for the Central Indiana Area
(MOVES-based Onroad Emissions)

	2006	2020
NOx	210.93	69.00
VOC	64.32	25.47

Through the interagency consultation process, it was determined that a maintenance plan horizon year budget of 2020, would be appropriate. The interagency consultation group approved onroad margins of safety of ten percent (10%) for NO_x and twelve percent (12%) for VOC onroad emission estimates for the year 2020. A summary of this interagency consultation discussion can be found in Appendix B. These revised emission inventories clearly illustrate that onroad NO_x and VOC emissions in the Central Indiana Area will continue to decline leading to local reductions between 2005 (base year) and 2020 (maintenance plan horizon).

Furthermore, when compared to the overall safety margin as defined in the Code of Federal Regulations (CFR) at 40 CFR 93.101, it is evident the onroad safety margin allocation is reasonable and appropriate. More specifically, even with the allocation of an onroad safety margin to mobile sources, emissions will continue to remain well below the overall safety margin for all sources in the Central Indiana Area as detailed in Table 4.1 – A. MVEBs are constrained to ensure that the total emissions (i.e., all source categories) do not exceed the 2005 attainment year emissions of either NO_x or VOC, thereby ensuring continued maintenance of the 1997 8-hour ozone standards.

Conclusion

This MOBILE6.2 to MOVES replacement update to the previously submitted 8-hour ozone maintenance plan for the Central Indiana Area incorporates onroad emission estimates and a revised MVEB using U.S. EPA's recently adopted MOVES model. MVEBs have been revised in anticipation of the mandatory use of the MOVES model in future transportation conformity

determinations. The onroad emission estimates were calculated using the MOVES-based emission factors and data extracted from the area's travel-demand model. Onroad safety margins for NOx and VOCs, established through the interagency consultation process, are included in order to account for the wide array of assumptions that are factored into the calculation process. MVEBs are also constrained to ensure that total NOx and VOC emissions (i.e., all source categories) do not exceed attainment year (2005) emissions to ensure continued maintenance of the 1997 8-hour ozone standard. With the addition of MOVES-based onroad safety margins applied to mobile sources, the Central Indiana Area will continue to remain well below the overall safety margins for all sources into the future. As such, the 8-hour ozone maintenance plan for the Central Indiana Area continues to meet all applicable CAA requirements.

Appendix A

Central Indiana
MOVES Methodology

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CAMBRIDGE SYSTEMATICS

Update of Indianapolis MPO Travel Demand Model Air Quality Pre- and Post-Processor to Reflect MOVES

technical

Memorandum

Final Draft

prepared for

Indianapolis Metropolitan Planning Organization

prepared by

Cambridge Systematics, Inc.

technical memorandum

Update of Indianapolis MPO Travel Demand Model Air Quality Pre- and Post-Processor to Reflect MOVES

prepared for

Indianapolis Metropolitan Planning Organization

prepared by

Cambridge Systematics, Inc.
100 CambridgePark Drive, Suite 400
Cambridge, MA 02140

date

December 1, 2011

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Introduction

The purpose of the air quality pre- and post-processor update was to transition from the current MOBILE6.2 based emissions module within the Indianapolis travel demand model (TDM) to MOVES2010a, the U.S. Environmental Protection Agency's (EPA) Motor Vehicle Emissions Simulator (MOVES) model. Further detail on the input data and planning assumptions used to run MOVES2010a, as well as the structure of the air quality pre- and post-processor (air quality module) within the TDM, are provided below. A user's guide to running the TDM air quality module is included as an appendix.

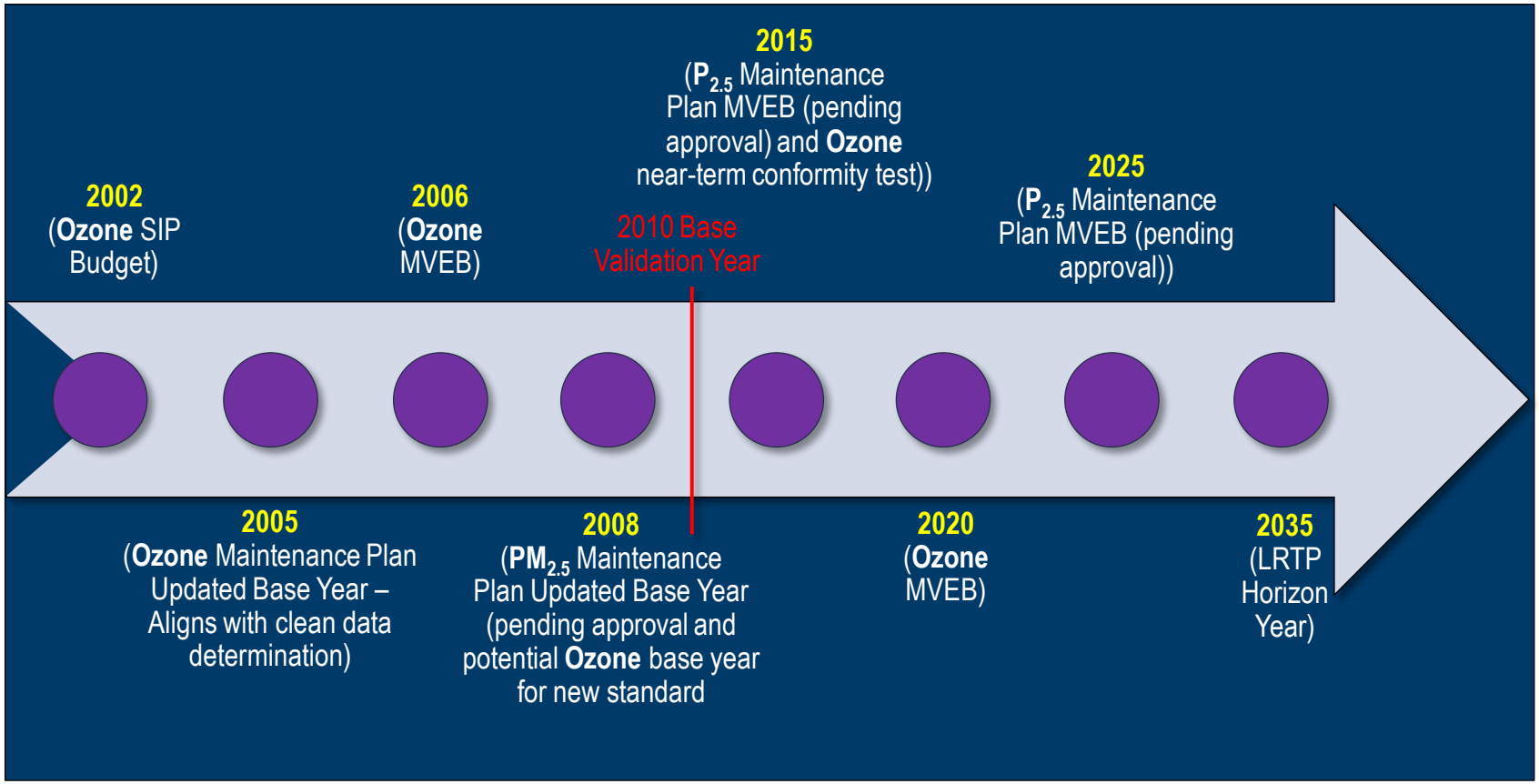
1.0 MOVES Input Data and Planning Assumptions

In order to automate the calculation of ozone and $PM_{2.5}$ emissions within the TDM post-processor, MOVES2010a was run in emission rate mode providing emission rates that were used as input files into the TDM post-processor and then applied to pre-processed travel activity data within the TDM to calculate emissions. Unless inputs into MOVES change, for example, fuel formulation data or a new inspection and maintenance (I/M) program in the Indianapolis area, it should not be necessary to run MOVES again until the next full update of the Indianapolis Long-Range Transportation Plan (LRTP) or every five years at a minimum.

1.1 AIR QUALITY ANALYSIS YEARS

Since the base validation year of the Indianapolis TDM is 2010, MOVES2010a was run for 2015, 2020, and 2025 representing future year runs necessary to created MOVES-based emissions for input into the $PM_{2.5}$ and Ozone Motor Vehicle Emissions Budgets (MVEB) as part of the State Implementation Plans (SIP). MOVES-based emissions for air quality years required prior to the base year of the model (i.e., 2002, 2005, 2006, and 2008) will be calculated off-model by the Indianapolis MPO. Figure 1.1 illustrates why each of the air quality analysis years were chosen. It should be noted that year 2035 is the current LRTP horizon year and as such, the Indianapolis MPO will be required to run MOVES at a later time for the purpose of the regional emissions analysis to complete their conformity determination.

Figure 1.1 Indianapolis MPO Air Quality Analysis Years



1.2 MOVE INPUTS

Table 1.1 demonstrates the general parameter inputs for MOVES, while Table 1.2 demonstrates the county data manager inputs, as agreed upon during interagency consultation in May and June of 2011[1].

Table 1.1 General Parameter Inputs in MOVES2010a

MOVES Screen	Input Item	Ozone	$PM_{2.5}$
Description	Description	User Choice	
Scale	Domain/Scale	County	
	Calculation Type	Emission Rate	
Time Spans	Time Aggregation Level	Hour	Hour
	Yeara	2002, 2005, 2006, 2015, 2020, 2035*	2008, 2015, 2025
	Months	July	April
	Days	Weekday	Weekday
	Hours	Select All	Select All
Geographic Bounds	Geographic Bounds[b]	Marion	Marion
Vehicles	Vehicles	All Gas and Diesel Combinations	
Road Type	Road Type	Select All	
Pollutants	Pollutants	VOC, NO_x, and supporting	$PM_{2.5}$ with all subspecies; NO_x
Processes	Processes		
General Output	Database Name	Marion Ozone	Marion $PM_{2.5}$
	Units	Select "Grams" and "Miles" and "Million BTU"	
	Activity	No Selections Required	
Output Emissions Detail	On Road	Select "Source Use Type"	

a Run future years first

b A MOVES run for Marion County will represent the entire Central Indiana Maintenance and Nonattainment Areas.

[1] It should be noted that while emission rate mode was chosen early in the course of the project, the project team later became aware of some bugs in EPA's MOVES emission rate calculations associated with the VOC refueling process and $PM_{2.5}$ tirewear process. While these calculation errors internal to MOVES are believed to result in only slightly different emissions results than if MOVES were run in Inventory mode, the exact size of the differences are unknown at this point.

* 2035 was run as an internal check to verify a reasonable margin of safety for mobile sources.

Table 1.2 County Data Manager Inputs in MOVES2010a

County Data Manager Input	Excel Sheet Tab Name	Ozone	$PM_{2.5}$
Source (Vehicle) Type Population	sourceTypeYear	2009 Light-Duty Registration Data for 9 Counties; MOVES Tech guidance method for heavy duty; human population to forecast future years	2009 Light-Duty Registration Data for 5 Counties; MOVES Tech guidance method for heavy duty; human population to forecast future years
Vehicle Type VMT (by 13 MOVES Vehicle Types)	HPMSVTypeYear	Model VMT with vehicle split from INDOT 18 Nonattainment ATR data	Model VMT with vehicle split from INDOT 18 Nonattainment ATR data
	MonthVMTFraction	INDOT Statewide ATR Data	
	DayVMTFraction	INDOT Statewide ATR Data	
	HourVMTFraction	INDOT 18 Nonattianment ATR Data	
Average Speed Distribution (percentage of VHT in each 5 mph speed bin)	avgSpeed Distribution	Not Needed for Emission Rate Mode (Dummy Inputs)	
Road Type Distribution (VMT by 5 MOVES Road Types)	roadType Distribution	Not Needed for Emission Rate Mode (Dummy Inputs)	
Age Distribution (Vehicle Population by Age of Vehicle)	sourceTypeAge Distribution	2009 Light-Duty Registration Data for 9 Counties; MOVES default age distributions for heavy-duty + motorcycles	
Ramp Fraction	RoadType	Local TDM results (2% rural, 8% urban).	
Meteorology Data	ZoneMonthHour	MOBILE6 Summer Met Data Converted to MOVES format	MOBILE6 Met Data for each of 4 seasons converted to MOVES format and then averaged to represent entire year.
Fuel (Percentage of Market Share by Fuel Type)	FuelFormulation	National Defaults	
	FuelSupply	Marion County MOVES Defaults for Summer (check if varies among counties)	Marion County MOVES Defaults for annual (check if varies among counties)

I/M Program	IMCoverage	No Program

2.0 TDM Pre- and Post-Processor

Emission rates generated by MOVES are used as inputs to the TDM post-processor. The TDM air quality model, or emissions module, which contains both the TDM pre- and post-processor can be run from the MPO model interface by checking the "Air Quality" option in the "Assignment" stage of the TDM's user interface. The entire process takes approximately 10 to 15 minutes to run depending on the computer system's specifications.

The TDM pre-processor provides some inputs to MOVES, such as VMT and road type distribution. Once emission factors are generated from MOVES, the emission factors are reformatted within the TDM in order to streamline the reading of the factors within the GISDK script and to get them in the format needed to apply to the travel activity data. The TDM pre-processor prepares the travel activity data on the model links in order to apply these factors and then the TDM post-processor calculates and summarizes both the running and non-running emissions. Figure 2.1 illustrates the overall emissions calculation process, while Figure 2.2 illustrates additional detail within each step.

Figure 2.1 Overview of Emissions Calculation Process

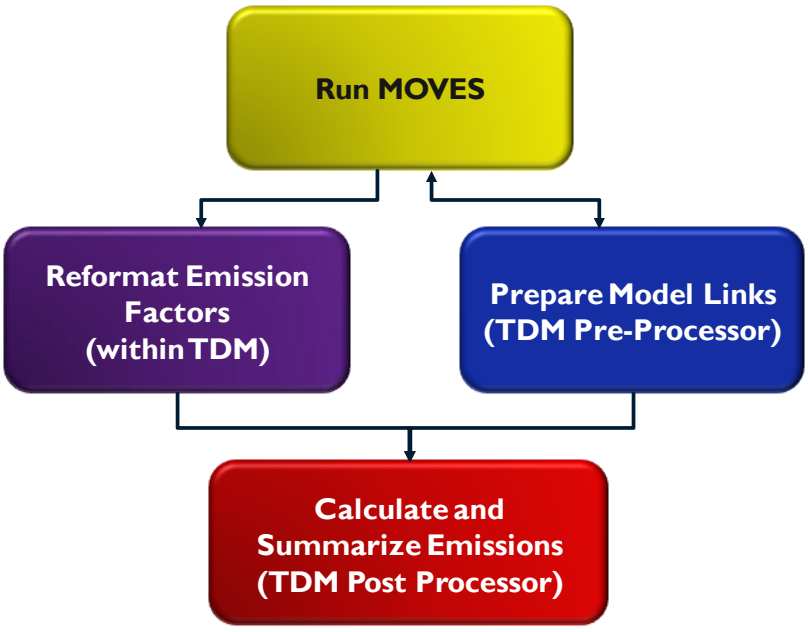


Figure 2.2 Flow Chart of Emissions Calculation Process

1 The five counties in the Indy PM2.5 Nonattainment Area include Hamilton, Hendricks, Johnson, Marion, and Morgan Counties. The 9 counties in the Indy Ozone Nonattainment Area include the above five counties plus Hancock, Shelby, Boone, and Madison Counties. Madison County is included in the Anderson MPO travel demand model. As a result, running emissions for Madison County will be calculated separately from the Indy MPO travel demand model. However, VMT from the Anderson MPO travel demand model are input into MOVES to calculate emissions factors that will be applied to the Madison MPO model travel activity data. It is anticipated that Madison County emissions will be added back in to the regional emissions outside the Indy air quality postprocessor.

2 Disaggregated by pollutant, process, source type (vehicle type), hour, road type, speed.

3 Nonrunning emissions factors are output as two tables – rate per vehicle, rate per profile.

4 Disaggregated by pollutant, process, source type (vehicle type).

5 Weighted emissions factors are created by first calculating the percent of VMT by MOVES source (vehicle) type using MOVES national defaults. The emissions factors for each of the 13 MOVES vehicle types are then aggregated to the 6 HPMS vehicle type categories by applying the weighted average to the rate. Total VMT from the Indy model is disaggregated to the 6 HPMS vehicle type categories by using the percent of VMT by vehicle type from HPMS data for the County. The weighted average emissions factor at the HPMS level is then applied to the disaggregated model VMT by HPMS vehicle type.

6 HPMS adjustment factors are calculated separately for each County.

2.1 INCLUDED COUNTIES

The TDM air quality model generates daily running emissions at the county level and at the Highway Performance Monitoring System (HPMS) functional class level. It generates the non-running daily emissions at the regional level based on vehicle population data. The counties included within the Indianapolis MPO boundary are: Marion, Hamilton, Johnson, Hendricks, Hancock, Shelby, Boone, Morgan, and Madison. The Anderson MPO TDM generates daily running emissions for Madison County. Historically, running emissions for Madison County have been calculated off-model by the Anderson MPO using MOBILE6.2 emission rates provided by the Indianapolis MPO. Similarly with MOVES, the Indianapolis MPO will provide the Anderson MPO with MOVES emission rates for the Anderson MPO to calculate Madison County running emissions and provide back to the Indianapolis MPO for inclusion in the overall Conformity Determination Report (CDR) for the entire Indianapolis nonattainment areas. The Indianapolis MPO will calculate non-running emissions for Madison County using vehicle populations from INDOT and the same non-running emissions rates used for the other counties. As a result, the TDM air quality module does not output running emissions for Madison County, but does output non-running emissions for Madison County.

The Ozone nonattainment area includes all nine counties and the $PM_{2.5}$ nonattainment area includes Hamilton, Hendricks, Johnson, Marion, and Morgan Counties. Therefore, $PM_{2.5}$ emissions output from the TDM air quality module for the other four counties (Hancock, Shelby, Boone, and Madison Counties) are set to zero.

2.2 AIR QUALITY MODULE SCRIPT STRUCTURE (MACROS)

The air quality post-processing script was written in GISDK to make it compatible with the other components of the TransCAD model. The air quality module script is embedded in the macro titled "AQ" within the overall model stream script. It calls the following macros:

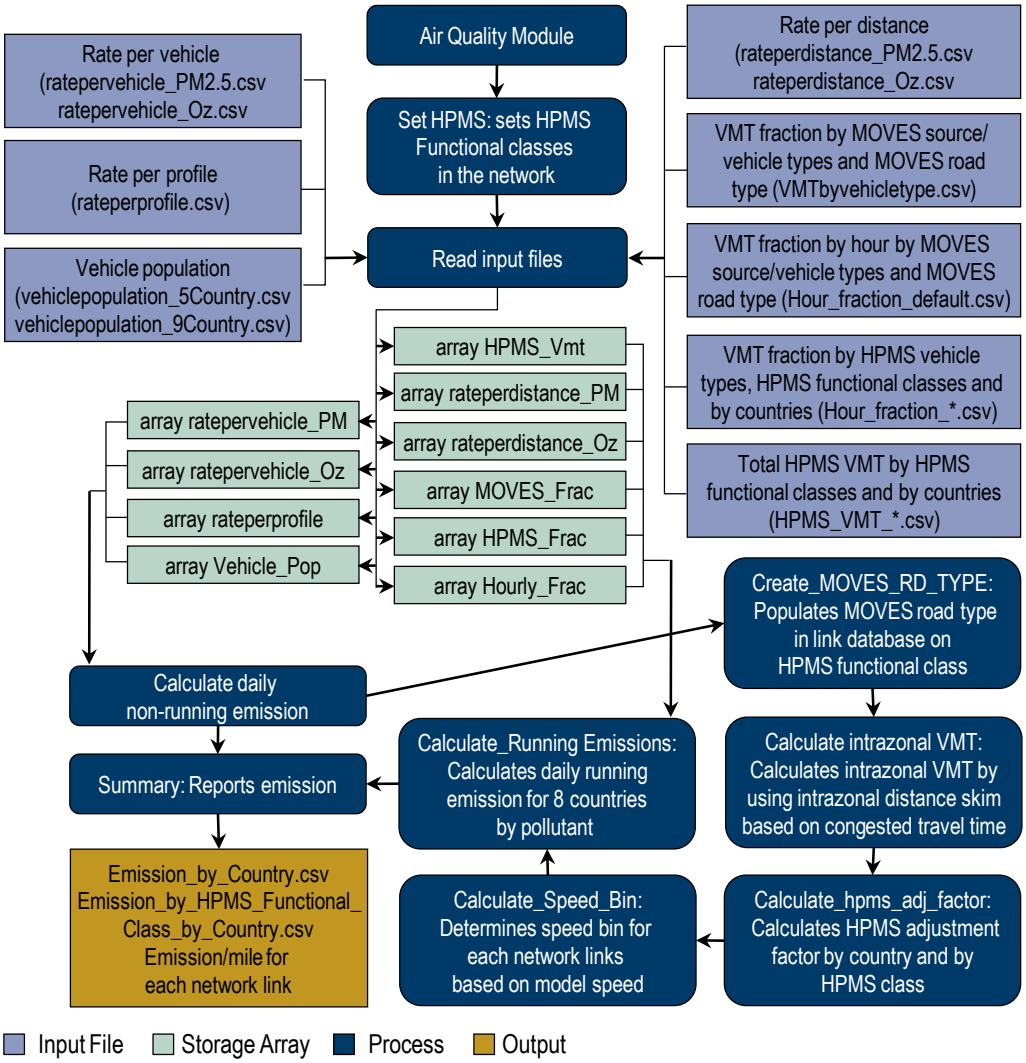
- Set_HPMS: Sets the HPMS functional class code in the line layer of the model network based on specified Facility Type and Area Type combinations on each link.
- ReadFiles: Reads the input files and stores the input data in arrays.
- Calculate_NonRunning_Emissions: Calculates the daily non-running emissions based on emission rates generated by MOVES and the vehicle population within the MPO model boundary.
- Create_MOVES_RD_TYPE: Populates each network link with a MOVES road type code based on an HPMS functional class code equivalency table.
- CalculateIntrazonalVMT: Calculates intrazonal Vehicle Miles Traveled (VMT) based on intrazonal travel distance and intrazonal trips. The intrazonal VMT includes all travel activity that begin and end within the

same traffic analysis zone and it is calculated for each time period and for both AB and BA directions.

- Calculate_hpms_adj_factor: Calculates adjustment factors based on the ratio of HPMS VMT to the model VMT. The adjustment factors are calculated for each of the HPMS functional class codes and for each of the nine counties. Based on previous interagency consultation discussions, HPMS adjustment factors are not currently used by the Indianapolis MPO and as such, these factors are set to 1.0.
- Calculate_Speed_Bin: Sets the speed bins for each network link based on congested model speeds for different times of day. It uses the five mile per hour (mph) speed bin ranges defined in MOVES to determine the speed bins for the network links.
- Calculate_Running_Emissions: This macro calculates the daily running emissions by applying the emission rates generated by MOVES to the weighted VMT.
- Summary: Summarizes the daily emissions by functional class and county.

Figure 2.3 illustrates the flow diagram of GISDK script for the air quality module.

Figure 2.3 Flow Diagram of GISDK Script for Air Quality Module



The following subsections provide further detail on each macro, or subroutine.

Setting the HPMS Functional Classification

The air quality module sets the HPMS functional class code for each network link based on its area type and facility type combination. Table 2.1 lists each of these combinations and their assigned HPMS functional classification code.

Table 2.1 HPMS Functional Class Codes Assigned Based on Area Type and Facility Type Combinations

HPMS Functional Class	Area Type	Facility Type
1	5	1, 7, 8, 9, 10, 11, 12
2	5	2, 4, 6
6	5	3
9	5	5
11	1, 2, 3, 4	1, 7, 8, 9, 10, 11, 12
12	1, 2, 3, 4	2
14	1, 2, 3, 4	4, 6
16	1, 2, 3, 4	3
19	1, 2, 3, 4	5

The assignment of HPMS Functional Class codes to each link in the network provides:

1. An equivalency attribute for MOVES road type codes, and
2. The ability to calculate HPMS adjustment factors by HPMS functional class if desired.

Reading Input Data

The air quality module reads the input files and stores the input data in multidimensional arrays. Table 2.2 provides a description of the input data.

Table 2.2 Description of Input files and Array Variables

1 Pollutant index is the position of the pollutant ID in the array of pollutants, poll_seq = [3,87,110,116,117]

2 Process index is the position of process ID in the array of processes, proc_seq = [1,2,9,10,11,12,13,15,16,17,18,19,90]

3 Source type index is the position of source type ID in the array of MOVES source types, veh_seq = [11,21,31,32,41,42,43,51,52,53,54,61,62]

4 Road type index is the position of MOVES road type ID in the array of MOVES road types, road_seq = [2,3,4,5]

5 County index is the position of county ID in the array, county = [1,2,3,4,5,6,7,8,9]

Input File Name	File Content
rateperdistance_ PM2.5.csv	**$PM_{2.5}$ Emission rate by pollutant process, by speed bin, by sourc by MOVES road type and by ho day**
rateperdistance_ Oz.csv	**Ozone Emission rate by pollutai process, by speed bin, by sourc by MOVES road type and by ho day**

6 HPMS vehicle class index is the position of HPMS vehicle class in the array of HPMS vehicle classes [10, 20, 30, 40, 50,60]

7 HPMS functional class index is the position of HPMS functional class in the array of HPMS functional classes

8 The array [rateperdistance], [ratepervehicle] and [rateperprofile] in embedded into the array of emission rate types, Emis_Array = [rateperdistance, ratepervehicle, rateperprofile]

Calculate Non-Running Emissions

The non-running emissions are produced by – vehicles when they are not in motion. The calculation process uses [ratepervehicle], [rateperprofile] and the vehicle population as input. It calculates the emission based on the following equations:

Daily non-running emissions by pollutant = emission from rate per vehicle by pollutant + emission from rate per profile by pollutant

emission from rate per vehicle by pollutant = ∑hour∑source∑process ratepervehicle vehicle population*

emission from rate per profile by pollutant = ∑hour∑source rateperprofile vehicle population*

In order to calculate Ozone emission which includes NO_x and VOC, it uses the total vehicle population in all nine counties. $PM_{2.5}$ rates are applied to the vehicle population of five counties. The non-running emissions are stored in the array variable, NREmissions[pollutant index].

Create MOVES Road Type

The MOVES road type is set based on the functional class. Below is the script that provides the criteria for assigning MOVES road type codes:

If HPMS = 11 or HPMS= 12 then MOVES_TYPE = 4 where MOVES_TYPE = 4 for urban restricted access

If HPMS = 1 or (HPMS= 2 and facility type =2) then MOVES_TYPE = 2 where MOVES_TYPE = 2 for rural restricted access

If HPMS > 12 then MOVES_TYPE = 5 where MOVES_TYPE = 5 for urban unrestricted access

If (HPMS >2 and HPMS <=9) or (HPMS = 2 and FACILTY_TYPE<>2) where MOVES_TYPE = 3 for rural unrestricted access

It was noticed in the model network that the roadways with an HPMS functional class code = 2 can be both restricted-access and unrestricted-access roadways. Therefore, the attribute "facility type" is used to differentiate between the roadways with restricted-access and the roadways with unrestricted-access.

Table 2.3 illustrates the HPMS Functional Class to MOVES Road Type equivalency table.

Table 2.3 HPMS Functional Class to MOVES Road Type Equivalency Table

MOVES Road Types	HPMS Functional Class
1	Out of network
2	1, 2
3	6, 9
4	11, 12
5	14, 16, 19

Period	
a.m.	
p.m.	
Off-peak	**6 p**

Calculate Intrazonal VMT

The air quality module calculates the model VMT by using assigned flow and the length of the network links. The model generates assigned flow table for three different time periods: a.m., p.m. and off-peak. Table 2.4 demonstrates the time spans of each time period.

Table 2.4 Hours Within Each Time Period

The intrazonal VMT at each TAZ is calculated from the time of day trip tables and the intrazonal distance skim. The intrazonal distance skim is generated from the shortest path based on congested travel time. In order to get the intrazonal skim, the average distance to the three nearest neighboring zones were multiplied by a factor of 0.5. The intrazonal VMT at each TAZ is distributed to the centroid connectors based on their share of the assigned VMT. The intrazonal VMT on each link connector is calculated from the following equations:

*AB/BA InrazonalVMT for centroid connector i= IntrazonalVMT at TAZ * share of assigned VMT at i*

share of assigned VMT at i = (AB/BA assigned flow)/(sum of the assigned flow at each centroid connectors of the TAZ)

The calculated intrazonal VMT at each link are then added to the assigned VMT of that link. The daily VMT on each link is being calculated by adding the VMTs of three time of day periods.

Calculate HPMS Adjustment Factor

The model VMT gets adjusted by the HPMS VMT. The HPMS VMTs are provided by INDOT. The HPMS VMTs are available by counties and by HPMS functional classes. The air quality module sets the HPMS adjustment factors for each of the network links by using the county and the HPMS functional class attribute of that link. The default value of HPMS adjustment factor is 1. HPMS adjustment factor is calculated by using the following equation:

avgSpeedBinID
1
2
3
4
5
6

HPMS_ADJ_FACT for county c and HPMS functional class h = (HPMS VMT for c and h)/(sum of model VMT for c and h)

Calculate Speed Bin

The air quality module sets the speed for each network link based their congested speeds. The congested speed for each link is calculated from the link length and the congested travel time. The congested travel time is generated by the highway assignment component of the model. The speed varies by time of day periods and by the direction of flow. Therefore, speed bin is determined for each time of day periods and for each of AB and BA direction. The speed bin for each link is being set by using the following criteria identified in Table 2.5.

Table 2.5 Speed Ranges Within Each Speed Bin

Calculate Running Emissions

The running emissions are generated from the moving vehicles. The running emission is calculated from rate per distance, travel data and the network attributes. It uses the following equation to calculate running emission for each of the network link:

*Daily running emission by pollutant = ∑hour∑HPMS Veh Class (hourly adjusted vmt * ∑process rateperdistance)*

Where rate per distance depends on speed bins and MOVES road type

In order to facilitate the calculation process, the air quality module creates a database titled EMIS_daily.bin. Each record in this file can be identified by network link Ids. Table 2.6 describes the fields in the database EMIS_Daily.bin.

Table 2.6 Field Descriptions of the Link Database (EMIS_Daily.bin)

Table 2.6 Field Descriptions of the Link Database (EMIS_Daily.bin) (continued)

Table 2.6 Field Descriptions of the Link Database (EMIS_Daily.bin) (continued)

Fields	
BA_OFFP_intravmt_factor	
BA_OFFP_intravmt_factor	
Length	assignment
BA_OFFP_VHT	
Count	assignment
AB_OFFP_SPEED	
AB_PM_intravmt_factor	
HPMS	

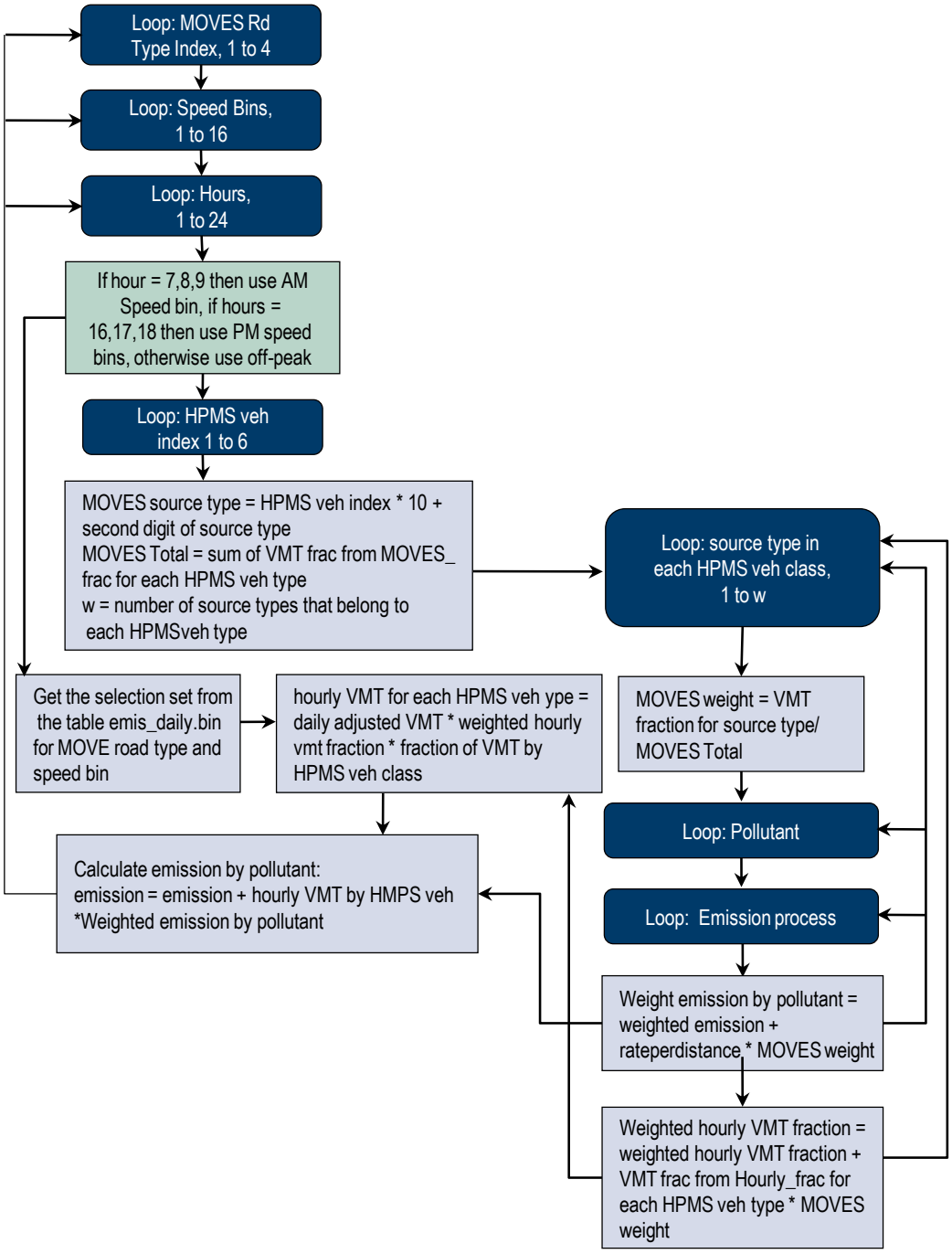
The running emission is calculated for each of the network links from rate per distance and the adjusted VMT. The rate per distance varies with hours of day, MOVES source type, MOVES road types, speed bins, emission processes and pollutants. The emission rate is calculated for each of the HPMS vehicle type categories. In order to do that, the program aggregates the rates by 13 MOVES source types to the rates by 6 HPMS vehicle classes be using a weighting factor. The factor is calculated from the array variable, MOVES_Frac, as described earlier in Table 2.2. This array stores the fraction of VMT by MOVES road type and MOVES source (vehicle) type. As a result, the weighting factor varies with MOVES road types and MOVES vehicle types. The factor is calculated by using the following equation:

> *The weighting factor = MOVES_Frac[road type index4][HPMS vehicle class index6][2nd digit of source type]/∑MOVES_Frac[road type index4][HPMS vehicle class index6]*

For each link of the network, the air quality module looks up the emission rates from the array variable, rateperdistance, by using the attributes such as the speed bins and road types for each MOVES source (vehicle) type, emission process, pollutant and hour of the day. The following flow chart (Figure 2.4) describes the process of calculating daily emissions by pollutant by HPMS vehicle classes.

The air quality module populates three new fields in the network's line layer: *Daily_NOx_per_mile, Daily_VOC_per_mile*, and *DAILY_PM25_per_mile*. These fields show the running emissions per mile for each link.

Figure 2.4 Process for Calculating Daily Running Emissions



Summary Macro

The air quality module stores the emission summaries in two separate files:

1. Emission_by_HPMS_Functinal_Class_by_County.csv
2. Emission_by_County.csv

The first file reports the daily running emissions by HPMS functional class and County. The second file reports the daily running emissions by County. Both of the files report daily non-running emissions for the region. Sample output is illustrated below in Tables 2.7 and 2.8.

Table 2.7 Emissions by HPMS Functional Class

Emission Type	HPMS Functional Class	County	Daily NOx for Ozone	Daily NOx for PM2.5	Daily VOC	Daily PM2.5
Running	Rural Interstate	Marion	229821	238420	12988	7738
Running	Rural Interstate	Hamilton	800571	830630	46146	27349
Running	Rural Interstate	Johnson	1062221	1102078	60897	36176
Running	Rural Interstate	Hendricks	1123555	1165610	63782	38139
Running	Rural Interstate	Hancock	24519	0	1886	0
Running	Rural Interstate	Shelby	1384248	0	78751	0
Running	Rural Interstate	Boone	2494053	0	141698	0
Running	Rural Interstate	Morgan	642205	666237	36355	21690
Running	Rural Principal Arterial	Marion	0	0	0	0
Running	Rural Principal Arterial	Hamilton	1082530	1099509	119769	38927
Running	Rural Principal Arterial	Johnson	825039	834039	97108	33886
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
Non-running		All Counties	22989168	19350230	20697327	237064

Table 2.8 Emissions by County

Emission Type	County	Daily NOx for Ozone	Daily NOx for PM2.5	Daily VOC	Daily PM2.5
Running	Marion	28055166	28388483	3904938	1231216
Running	Hamilton	7361642	7416047	1047001	322120
Running	Johnson	4054185	4106645	490529	163288
Running	Hendricks	4548314	4597461	572896	185621
Running	Hancock	2571251	0	318755	0
Running	Shelby	2682064	0	245505	0
Running	Boone	4120728	0	357362	0
Running	Morgan	2694182	2724933	310788	106299
Running	All 8 Counties	56087532	47233569	7247774	2008543
Non-running	All Counties	22989168	19350230	20697327	237064

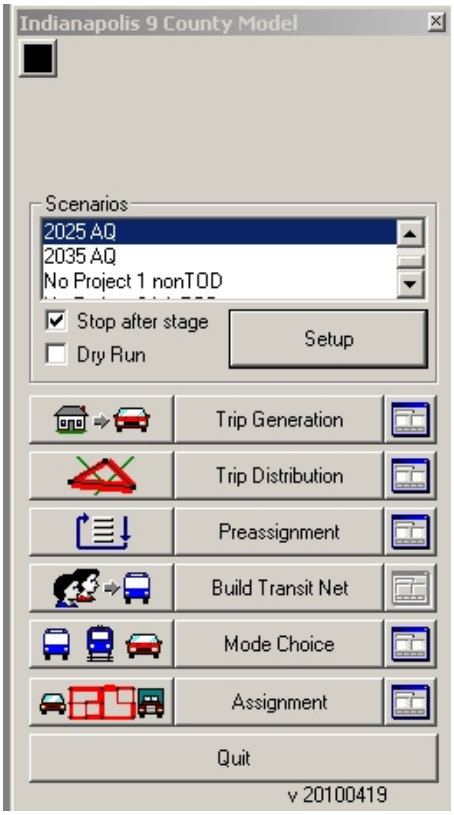
Appendix A includes a user's guide on how to run the air quality module with the Indianapolis MPO TDM.

A. Appendix: User's Guide to Running TDM Air Quality Module

Running air quality module from the Model Interface:

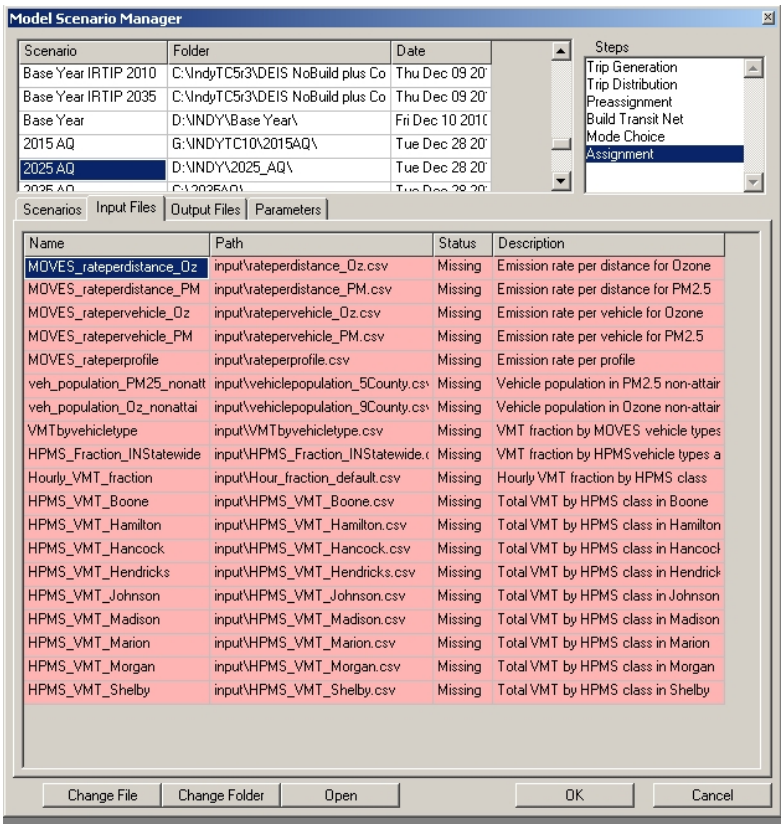
Step 1:

Open the model interface, select the scenario and click on the setup button to open the scenario manager window.



Step 2:

In the model scenario manager window, select *"Assignment"* from the list and click on the *Input Files* tab. Click on the button *"Change File"* to select file from the file browser window. All the files in the list must be available to the user.



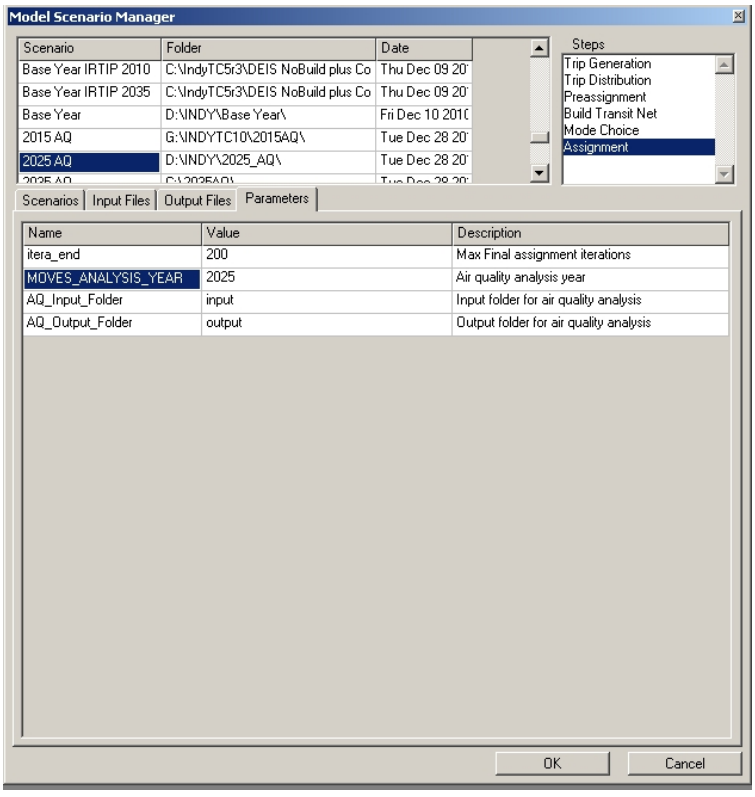
Step 3:

The air quality module script includes the code to calculate HPMS adjustment factors based on HPMS_VMT_*.csv. Currently, this block of code is commented out in the script since the Indianapolis MPO currently does not use HPMS adjustment factors based on previous interagency consultation. Since the model table will look for these files, the user needs to create a dummy set of csv files (HPMS_VMT_*.csv) for each of the counties in the following format:

HPMS CLASS	HPMS VMT	DEFINITION
1	372202	Rural Principal Arterial Interstate
2	18942	Rural Principal Arterial Other
6	82512	Rural Minor Arterial
9	0	Rural Local
11	646109	Urban Principal Arterial Interstate
12	0	Urban Principal Arterial Other Freeway
14	34486	Urban Principal Arterial Other
16	549584	Urban Minor Arterial
19	324050	Urban Local

Step 4:

In the *Parameters* tab of the scenario manager, set the parameter to "*MOVES_ANALYSIS_YEAR*" and then click the button "*ok*."



Step 5:

In the model user interface, click on the button  next to the button "Assignment." Check the option *"Air Quality Model"* and click the button *"ok."* Then click on the button *"Assignment."*

Appendix B

Central Indiana

Interagency Consultation Group Meeting Minutes/Summary

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Interagency Consultation Group (ICG) Conference Call Minutes

For the MOBILE6.2 to MOVES MVEB Replacement Update
Related to the Indianapolis, Indiana Maintenance Area under the 1997 8-Hour Ozone Standard

ICG Conference Call Date and Time

- January 18, 2012 at 1pm Eastern

ICG Attendees

- Shawn Seals (IDEM), Gale Ferris (IDEM), Patricia Morris (EPA), Steve Smith (INDOT), Laurence Brown (INDOT), Larry Heil (FHWA), Stephanie Belch (Indy MPO), Catherine Schoenherr (Indy MPO), Philip Roth (Indy MPO), Steve Cunningham (Indy MPO) and Vince Bernardin (BLA)

ICG Discussion Topics and Conclusions

1. The question of whether or not non-running emissions should be included in MVEBs as we move forward was raised.
   A. It was determined by consensus of the ICG that both running and non-running emissions were appropriate for inclusion in the MVEBs.
   B. A revised ICG discussion spreadsheet was subsequently developed to include an additional line of totals with both running and non-running emissions that are included as the baseline for the mobile source margins of safety and the all source margin of safety discussions.
2. The question of using one annual run, or four seasonal runs was raised.
   A. After discussion of the ICG, the consensus was the one annual run was reasonable and appropriate for MOVES runs.
3. For the PM2.5 MVEB Replacement submittal, various mobile source margins of safety were discussed.
   A. The originally submitted PM2.5 SIP submittal included a 22% mobile source margin of safety that was inflated for the purpose of accommodating the uncertainties of the transition from 2004 to 2009 Indiana vehicle fleet mix.
   B. After discussion, the consensus of the ICG was that as long as a 15% for PM2.5 and NOx mobile source margin of safety did not result in an exceedance of the all sources margin of safety, it was reasonable and appropriate for inclusion in MVEB Replacement submittal. The subsequent spreadsheet mentioned above demonstrated that a 15% mobile source margin of safety falls well below the all sources margin of safety and, as such, will be reflected in the PM2.5 MVEB Replacement submittal.
4. For the Ozone MVEB Replacement submittal, various mobile source margins of safety were discussed.

A. The originally submitted Ozone SIP submittal included a 12% mobile source margin of safety for VOC, with a 10% margin of safety for NOx.
B. After discussion, the consensus of the ICG was that as long as the existing 12% for VOC and 10% for NOx mobile source margins of safety do not result in an exceedance of the all sources margins of safety, it was reasonable and appropriate for inclusion in MVEB Replacement submittal. The attached spreadsheet demonstrates that a 12% for VOC and 10% for NOx mobile source margins of safety fall well below the all sources margins of safety and, as such, will be reflected in the Ozone MVEB Replacement submittal.
C. After further study, Indy MPO requested additional time to conduct a 2035 MOVES-based emissions projection to confirm that the recommended mobile source margins of safety for the Ozone SIP submittal will be adequate farther into the future. After the 2035 projection was complete, it was confirmed that the recommended mobile source margins of safety for the submittal would be adequate.

LEGAL NOTICE OF PUBLIC HEARING

Motor Vehicle Emission Budgets Replacement Update to the Maintenance Area of Indianapolis, Indiana for the 1997 8-Hour Ozone Standard

Notice is hereby given under 40 CFR 51.102 that the Indiana Department of Environmental Management (IDEM) is accepting written comment and providing an opportunity for public hearing regarding the Motor Vehicle Emission Budget (MVEB) replacement update to the Indianapolis, Indiana maintenance area under the 1997 8-hour ozone standard. Onroad emissions for the original submittal were calculated using the MOBILE6.2 mobile model and are now being replaced with the United States Environmental Protection Agency's (U.S. EPA's) recently adopted Motor Vehicle Emissions Simulator (MOVES) mobile model. All interested persons are invited and will be given reasonable opportunity to express their views concerning the submittal of the proposed MVEB replacement update to the maintenance area of Indianapolis, Indiana.

The purpose of this notice is to solicit public comment on Indiana's proposed MVEB replacement update. The Indianapolis, Indiana area was designated as nonattainment for the 1997 8-hour ozone standard and subject to the requirements of Section 172 of the Clean Air Act (CAA). One of the compliance requirements mandated by Section 175A(b) of the CAA, is the development of a plan demonstrating that ozone maintenance areas will continue to meet the 8-hour ozone standard for the next ten years, which includes MVEBs for onroad sources, beyond the current maintenance period. This submittal of the proposed MVEB replacement update to the maintenance area of Indianapolis, Indiana is being drafted and submitted consistent with U.S. EPA guidance. Upon completion of this public notice process, the MOBILE6.2-based to MOVES-based MVEB replacement updates will be submitted to U.S. EPA for approval into the State Implementation Plan.

Copies of the draft documents will be available on or before February 24, 2012, to any person upon request and at the following locations:

- Indiana Department of Environmental Management, Office of Air Quality, Indiana Government Center-North, 100 North Senate Avenue, 10th Floor-East Wing, Indianapolis, Indiana

- Indianapolis-Marion County Public Library-West Indianapolis Branch, 1216 South Kappes Street, Indianapolis, Indiana

The draft documents will also be available on the following web page:

http://www.in.gov/idem/4658.htm

An electronic version of all MOVES mobile model input and output files will be available at the public hearing or upon request.

Any person may submit written comments on the MVEB replacement update to the maintenance area of Indianapolis, Indiana on or before March 30, 2012. Written comments should be directed to Mr. Shawn Seals, Mail Code 61-50, Office of Air Quality, Indiana Department of Environmental Management, 100 North Senate Avenue, Indianapolis, Indiana 46204; or fax (317) 233-5967; or email at SSeals@idem.in.gov. Interested parties may also present oral or written comments at the public hearing, if held.

A public hearing on the MVEB replacement update to the maintenance area of Indianapolis, Indiana will be held if a public hearing request is received by March 22, 2012. A hearing has been scheduled for March 29, 2012. The hearing will convene at 6:00 p.m. local time at the Indianapolis-Marion County Library-West Branch, 1216 South Kappes Street, Indianapolis, Indiana. If a request for a public hearing is not received by March 22, 2012, the hearing will be cancelled. Interested parties can check the online IDEM calendar at http://www.in.gov/idem/calendar.html or contact Mr. Shawn Seals at the provided contact information after March 22, 2012, to see if the hearing has been cancelled.

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Individuals requiring reasonable accommodations for participation in this hearing, if held, should contact the IDEM Americans with Disabilities Act (ADA) coordinator at:

Attn: ADA Coordinator
Indiana Department of Environmental Management – Mail Code 50-10
100 North Senate Avenue
Indianapolis, IN 46204-2251

Or call (317) 233-1785 (voice) or (317) 232-6565 (TDD). Please provide a minimum of 72 hours notification.

A 3/6/12

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LEGAL NOTICE OF PUBLIC HEARING
Motor Vehicle Emission Budgets Replacement Update to the Maintenance Area of Indianapolis, Indiana for the 1997 8-Hour Ozone Standard

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